R008-10
C 会場 ： 11/26　PM2（14:50-16:20）
15:35〜15:50:00

電子-陽電子-イオンプラズマ中の相対論的衝撃波による陽電子の選択的加速メカニズムと天体への応用

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Selective positron acceleration by relativistic electron-positron-ion shocks and its application to astronomical objects

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The origin of the high energy positron cosmic rays remains an open question. Space experiments such as PAMELA, Fermi-LAT, and AMS-02 have reported that the flux ratio of positrons to electrons, the positron fraction, at energies above 10 GeV exceeded expectations from the theories that are based on the secondary positron model, implying the existence of other sources of high-energy primary positrons. Detailed mechanisms of charged particles' accelerations have been studied using the ab initio particle-in-cell (PIC) simulations. Our presentation last year indicated that upstream positrons were preferentially accelerated in relativistic magnetized electron-positron-ion shocks when the positron fractions were small enough to generate the wakefield by performing 1D PIC simulations.

In this study, we present detailed acceleration mechanisms and conditions for efficient positron acceleration. Test particle simulations modeling an interaction between the wakefield and relativistic particles under ambient magnetic field revealed that preferential positron acceleration takes place when the amplitude of wakefield surpasses the ambient magnetic field strength in the plasma rest frame. This process was found to be consistent with the acceleration mechanism referred to as the relativistic E $\times$ B acceleration (Takeuchi 2003, Friedman & Semon 2005). In addition, we estimated the energy gain from this acceleration and discussed which types of astronomical objects could efficiently facilitate this mechanism. In this presentation, we will present the detailed acceleration mechanism and its implications to the high-energy primary positrons, and discuss future perspectives including multi-dimensional effects.